Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

High-Intensity Bragg Reflection of a Femtosecond Laser via Ionized Structures in Air[1] M. R. EDWARDS, Lawrence Livermore Natl Lab, N. M. FASANO, Princeton Univ., N. LEMOS, Lawrence Livermore Natl Lab, A. SINGH, E. KUR, J. S. WURTELE, University of California, Berkeley, J. M. MIKHAILOVA, Princeton Univ., P. MICHEL, Lawrence Livermore Natl Lab — Plasma optics can manipulate high power lasers at far higher fluences than solid-state components. The difference in index of refraction between air and plasma provides one method to control high intensity light. We use the spatial beat wave between 50-fs beams crossed at an angle to create a volumetric ionization grating in air; the intensity modulation produces a one-dimensional grating with alternating regions of plasma and neutral gas. We experimentally demonstrate redirection of millijoule-scale 40 fs pulses by an ionization grating and characterize the effects of spatial and temporal overlap of both pump beams and the probe. Direct interferometry measurements capture the evolution of plasma density in the grating during its sub-picosecond formation and subsequent exponential decay over tens of picoseconds. Three-dimensional simulations reproduce observed diffraction patterns and efficiencies. Control of light at intensities above the damage threshold of solid optics suggests a path towards smaller beam diameters for high power lasers.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344 and was supported by LLNL LDRD project 20-ERD-057. This work was partially supported by NSF grant PHY1806911 and DOE grant DE-SC0017907. LLNL-ABS-811856.

Matthew Edwards
Lawrence Livermore Natl Lab

Date submitted: 26 Jun 2020 Electronic form version 1.4